



## [Specification]

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**Title of the Invention:** Brown Rice Germination Apparatus and Method

## [Abstract]

Provided are a brown rice germination apparatus and method capable of preventing decay of brown rice during germination and accelerating germination growth to thereby germinate a large amount of brown rice in a short time and remove an odor generated during the germination.

The brown rice is germinated by driving a first underwater motor to supply water stored in a water tank into a germination vessel in a circulation manner to clean the brown rice disposed on a porous plate and soak the brown rice, re-supplying water thereto to germinate the brown rice in the water while discharging the water in the germination vessel at predetermined time intervals, and driving an air injection motor to supply the fresh air to the brown rice into which moisture on the porous plate is permeated.

Therefore, it is possible to produce a large amount of brown rice, prevent an odor caused by malted wheat during germination of the brown rice, and reduce water consumption since there is no need to renew the water at predetermined time intervals.

## **[Brief Description of the Drawings]**

FIG. 1 is a schematic perspective view of a brown rice germination apparatus in accordance with a first exemplary embodiment of the present invention;

FIG. 2 is a longitudinal cross-sectional view of a germination vessel for cleaning, soaking, and germinating brown rice used in the brown rice germination apparatus in accordance with the first exemplary embodiment of the present invention;

FIG. 3 is a cross-sectional view taken along line III-III of FIG. 2;

FIG. 4 is a block diagram of a control circuit for automatically controlling the brown rice germination apparatus in accordance with the first exemplary embodiment of the present invention; and

FIG. 5 is a schematic perspective view of a multi-stage germination vessel formed of cleaning, soaking, water circulation and air injection vessels of a brown rice germination apparatus in accordance with a second exemplary embodiment of the present invention.

### **<Description of Major Reference Numerals>**

10: Water tank	10a: Introduction chamber
10b: Discharge chamber	10c: Drain valve
12: Germination vessel	12a: Bottom surface
14: Support member	14a: Stationary support frame
14b: Movable support frame	16: Porous plate
16a: Brown rice	18: Water supply pipe
20: First underwater motor	21: Floater
22: Overflow pipe	24: Water circulation pipe

24a: Water circulation valve	26: Timer
28: Heater	30: Temperature detector
32: Discharge pipe	32a: Branch pipe
34: Overflow valve	36: Drain valve
38: Charcoal filter	40: Air injection motor
42: Air supply pipe	44: Air supply valve
45: Second underwater motor	45a: Water ejection head
46: Germinated brown rice drain vessel	46a: Mesh
46b: Handle	48: Rice discharge pipe
48a: Rice discharge port	50: Rice discharge valve

## **[Detailed Description of the Invention]**

### **[Object of the Invention]**

### **[Technical Field and Background]**

The present invention relates to a brown rice germination apparatus and method capable of preventing decay of brown rice during germination and accelerating germination growth to thereby germinate a large amount of brown rice in a short time and remove an odor generated during the germination.

Generally, in order to germinate brown rice, the brown rice is soaked and cleaned in a predetermined temperature of water, and immersed in the water for 1 - 8 hours. Thereafter, immersion and standby processes are repeated until the brown rice germinates to a predetermined level.

However, when the brown rice is germinated using the above method, it is

impossible to germinate a large amount of brown rice, an odor of malted wheat is generated during germination and the brown rice may be decayed.

In addition, since the conventional brown rice germination method requires renewal of water at predetermined time intervals, it is impossible to save water.

### **[Summary of the Invention]**

In order to solve the problems, it is an object of the present invention to provide a brown rice germination apparatus and method capable of germinating a large amount of brown rice.

It is another object of the present invention to provide a brown rice germination apparatus and method capable of preventing generation of an odor of malted wheat during germination of the brown rice.

It is still another object of the present invention to provide a brown rice germination apparatus and method capable of circulating water to remove the need to renew the water, thereby reducing water consumption.

It is yet another object of the present invention to provide a brown rice germination apparatus and method capable of preventing decay of brown rice during germination and accelerating germination growth even though the temperature of water is high.

In order to accomplish the above objects, the present invention is directed to a brown rice germination apparatus including: a water tank having an introduction chamber for introducing water and a discharge chamber for discharging and storing water; a germination vessel for cleaning and germinating brown rice; a porous stainless plate mounted on a support member installed at both sidewalls of the germination vessel

and on which brown rice is disposed on its upper surface to a predetermined thickness; a first underwater motor installed in the water tank and supplying water into the germination vessel through a water supply pipe to clean brown rice disposed on the porous plate and germinate the brown rice in the water; a floater for stopping water being supplied through the water supply pipe when water is supplied into the germination vessel to more than a predetermined level; an overflow pipe installed at one side of an upper part of the germination vessel and overflowing water supplied into the germination vessel by driving the first underwater motor; a timer for counting a water circulation time carried out by the first underwater motor to cut a power supply applied to the first underwater motor when a predetermined time elapses; a heater installed under the germination vessel and heating water stored in the germination vessel; a temperature detector for detecting a temperature of water stored in the germination vessel and for cutting a power supply applied to the heater when a temperature is increased to more than a certain value; a discharge pipe for discharging water stored in the germination vessel; an overflow valve installed at a branch pipe of the discharge pipe to control the supply of water discharged from the discharge pipe and the overflow pipe into the introduction chamber of the water tank; a drain valve for discharging water discharged from the discharge pipe and the overflow pipe to the exterior; a charcoal filter for receiving water introduced through the water circulation pipe, filtering foreign substances from the water, discharging the water into the discharge chamber of the water tank, and being formed of oak charcoal; an air injection motor for supplying fresh air to the brown rice, into which moisture on the porous plate is permeated, after opening the drain valve to discharge the water stored in the germination vessel; an air supply valve for controlling the air supplied through a pipe by driving the air injection

motor; and a rice discharge valve installed at a rice discharge pipe and discharging the brown rice germinated on the porous plate by way of water ejected from a water ejection head, by driving a second underwater motor, into a germinated brown rice dry container.

In addition, a brown rice germination method in accordance with the present invention includes an activation step of evenly spreading cleaned and brown rice on a porous plate to a thickness of 5 - 10cm, and driving a first underwater motor for 5 - 8 hours to supply 25 - 30°C water stored in a discharge chamber of a water tank into a germination vessel in a circulation manner to permeate moisture into albumen of the brown rice to a concentration of more than 30%, thereby activating the brown rice; an air germination step of supplying fresh air heated to 25 - 30°C to the brown rice which was activated during the brown rice activation step and the germination vessel for 2 - 3 hours in order to germinate the brown rice in the air; an air/underwater germination step of supplying 32 - 37°C water stored in the discharge chamber of the water tank to the brown rice germinated and grown in the air germination step and the germination vessel for 2 - 3 hours in order to repeat germination in the water and germination in the air; and a dry step of receiving the brown rice that has been germinated to a pre-determined size and removing moisture from the germinated brown rice.

### **[Detailed Description of the Invention]**

Hereinafter, a brown rice germination apparatus in accordance with a first exemplary embodiment of the present invention will be described in detail with reference to the accompanying drawings.

FIG. 1 is a schematic perspective view of a brown rice germination apparatus

in accordance with a first exemplary embodiment of the present invention; FIG. 2 is a longitudinal cross-sectional view of a germination vessel for cleaning, soaking, and germinating brown rice used in the brown rice germination apparatus in accordance with the first exemplary embodiment of the present invention; FIG. 3 is a cross-sectional view taken along line III-III of FIG. 2; FIG. 4 is a block diagram of a control circuit for automatically controlling the brown rice germination apparatus in accordance with the first exemplary embodiment of the present invention; and FIG. 5 is a schematic perspective view of a multi-stage germination vessel formed of cleaning, soaking, water circulation and air injection vessels of a brown rice germination apparatus in accordance with a second exemplary embodiment of the present invention.

As shown in FIGS. 1 to 5, a brown rice germination apparatus in accordance with a first exemplary embodiment of the present invention includes: a water tank 10 having an introduction chamber 10a for introducing water and a discharge chamber 10b for discharging to store water; a germination vessel 12 for cleaning and germinating brown rice; a porous stainless mesh or plate 16 mounted on a support member 14 installed at both sidewalls of the germination vessel 12 and on which brown rice 16a is disposed on its upper surface to a predetermined thickness; a first underwater motor 20 installed in the water tank 10 to supply water into the germination vessel 12 through a water supply pipe 18 to clean the brown rice 16a disposed on the porous plate 16 and simultaneously germinate the brown rice 16a in the water; a floater 21 for stopping the water being supplied through the water supply pipe 18 when water is supplied into the germination vessel 12 to more than a predetermined level; an overflow pipe 22 installed at one side of an upper part of the germination vessel 12 to overflow water supplied into the germination vessel 12 by driving the first underwater motor 20; a timer 26 for

counting a water circulation time carried out by the first underwater motor 20 in order to cut a power supply applied to the first underwater motor 20 when a predetermined time elapses; a water circulation valve 24a for stopping water flow; a heater 28 installed under the germination vessel 12 to heat water stored in the germination vessel 12; a temperature detector 30 for detecting a temperature of the water stored in the germination vessel 12 and cutting the power supply applied to the heater 28 when the temperature is increased to more than a certain value; a discharge pipe 32 for discharging the water stored in the germination vessel 12; an overflow valve 34 installed at a branch pipe 32a of the discharge pipe 32 to control the supply of water discharged from the discharge pipe 32 and the overflow pipe 34 into the introduction chamber 10a of the water tank 10; a drain valve 36 for discharging the water discharged from the discharge pipe 32 and the overflow pipe 22 to the exterior; a charcoal filter 38 for receiving water and foreign substances introduced through the overflow valve 34 and removing an odor, and being formed of oak charcoal; an air injection motor 40 for supplying fresh air to the brown rice 16a into which moisture on the porous plate 16 is permeated, after opening the drain valve 36 to discharge the water stored in the germination vessel 12; an air supply valve 44 for controlling the air supplied through an air supply pipe 42 by driving the air injection motor 40; and a rice discharge valve 50 installed at a rice discharge pipe 48 to discharge the brown rice 16a germinated on the porous plate 16 by way of water ejected from a water ejection head 45a by driving a second underwater motor 45 into a germinated brown rice dry container 46.

The water tank 10 includes a charcoal filter 38 installed at its center part for filtering foreign substances contained in water. In addition, the water tank 10 includes the introduction chamber 10a for introducing water through the charcoal filter 38, a

discharge chamber 10b for supplying water into the germination vessel 12 through the pipe 18 by driving the first underwater motor 20, and a drain valve 10c for discharging water from the discharge chamber 10b.

As shown in FIG. 2, the germination vessel 12 has a bottom surface 12a downwardly sloped toward a rice discharge port 48a, and the support member 14 installed at its both sides. The support member 14 includes a stationary support frame 14a for supporting the porous plate 16, and a movable support frame 14b for supporting the porous plate 16 and reciprocating to pivot the porous plate 16 about the stationary support frame 14a.

The germinated brown rice dry container 46 has a stainless mesh 46a installed at a lower part thereof to discharge water, and a handle 46b installed on its outer periphery.

Hereinafter, operations and effects of the brown rice germination apparatus and method in accordance with a first exemplary embodiment of the present invention will be described with reference to the accompanying drawings. First, clean brown rice 16a is poured onto a porous plate 16 in a germination vessel 12, a switch SW1 is turned ON, and a timer 26 is set for 2 - 5 minutes to apply a power supply P to a first underwater motor 20. As a result, water stored in a discharge chamber 10b of a water tank 10 is supplied into the germination vessel 12 through a water supply pipe 18 to clean the brown rice 16a on the porous plate 16 two or three times. At this time, since a drain valve 36 installed at a discharge pipe 32 is open, the water used to clean the brown rice is discharged to the exterior through the discharge pipe 32 and the drain valve 36.

After cleaning the brown rice 16a, the brown rice 16a is evenly spread on the

porous plate 16 to a thickness of about 5 - 10cm. When the drain valve 36 is closed, the first switch SW1 is turned ON, and a timer 26 is set for 5 - 8 hours. Power P is applied to the first underwater motor 20 to supply 25 - 30°C water stored in the discharge chamber 10b of the water tank 10 to the germination vessel 12 through the water supply pipe 18, and to supply the 25 - 30°C water stored in the discharge chamber 10b of the water tank 10 to an introduction chamber 10a of the water tank 10 through the discharge pipe 32 and a branch pipe 32a. Foreign substances contained in the water introduced into the introduction chamber 10a of the water tank 10 are filtered by a charcoal filter 38 disposed at a center part of the water tank 10, and then the water introduced into the introduction chamber 10a is continuously circulated through the discharge chamber 10b of the water tank 10. As a result, the water is supplied into the germination vessel 12 for the hours set by the timer 26 to permeate moisture into the albumen (the interior part) of the brown rice 16a to a concentration of more than 30%, thereby activating the brown rice (an activation step of the brown rice (16a)).

When the time (5 - 8 hours) set by the timer 26 elapses, an overflow valve 34 installed at the branch pipe 32a is closed, the drain valve 36 installed at the discharge pipe 32 is opened to discharge the water in the germination vessel 12 to the exterior, and then the drain valve 36 is closed.

Next, a switch SW2 is turned ON to apply power P to an air injection motor 40, thereby driving the air injection motor 40. At this time, a directional valve 44 as an electronic valve installed at a water supply pipe 42 is opened to supply 25 - 30°C fresh air to the germination vessel 12 for 2 - 3 hours, thereby germinating the brown rice 16a in the air (a step of germinating the brown rice in the air).

Next, the air injection motor 40 is turned OFF to stop the air supply to the germination vessel 12, and specifically, to the brown rice 16a on the porous plate 16. Then, the first switch SW1 is turned ON, and the timer 26 is set for 2 - 3 hours to drive the first underwater motor 20 so that 32 - 37°C water stored in the discharge chamber 10b of the water tank 10 is circulated as described above and supplied into the germination vessel 12 to germinate the brown rice in the water (a step of germinating the brown rice in the water).

When the first underwater motor 20 is driven to supply 32 - 37°C water stored in the discharge chamber 10b of the water tank 10 onto the germination vessel 12, a third switch SW3 is turned ON at one hour intervals to drive a second underwater pump 45 to pump the water stored in the discharge chamber 10b of the water tank 10 so that the water is ejected through a water ejection head 45a to turn the brown rice 16a on the porous plate 16 upside down, thereby preventing damage to the rice bran (the seedcase or the seed coat) of the brown rice on the porous plate 16.

Next, the water supplied into the germination vessel 12 through the water supply pipe 18 by driving the first underwater motor 20, and the water stored in the discharge chamber 10b of the water tank 10 by driving the second underwater motor 45, are introduced into the overflow valve 34 through the overflow pipe 22 and into the introduction chamber 10a of the water tank 10 through the branch pipe 32a. Then the water is filtered by the charcoal filter 38 to be discharged into the discharge chamber 10b of the water tank 10. At this time, when the water is excessively supplied into the germination vessel 12, a floater 21 operates to stop the water introduced through the water supply pipe 18.

When the activated brown rice and their germs grow to 1mm - 1.5mm or

2.5mm - 3mm, and more than 6mm, the drain valve 36 and the overflow valve 34 are closed. Then, a movable support frame 14b of the support member 14 is moved outward to pivot the porous plate 16 about a stationary support frame 14a, thereby pouring the brown rice germinated on the porous plate 16 onto the bottom surface 12a of the germination vessel 12.

Next, the third switch SW3 is turned ON to drive the second underwater motor 45 to eject water from the water ejection head 45a so that the germinated brown rice on the bottom surface 12a of the germination vessel 12 is discharged into the germinated brown rice dry container 46 together with the water through the rice discharge port 48a, the rice discharge valve 50, and the rice discharge pipe 48. As a result, the water is discharged to the exterior through the stainless mesh 46a of the germinated brown rice dry container 46, and the germinated brown rice is conveyed to a drier (not shown) to be dried to have a moisture of 12 - 15% and then vacuum-packaged as a commercial product.

Hereinafter, a brown rice germination apparatus in accordance with a second exemplary embodiment of the present invention will be described.

The brown rice germination apparatus in accordance with a second exemplary embodiment of the present invention has a structure in which the germination vessels 12 of the brown rice germination apparatus of the first embodiment of the present invention are installed in parallel in a multi-stage array. Since the apparatus of the second embodiment operates in the same way as the first embodiment, like reference numerals designate like elements, and their description will be not repeated.

Although the present invention has been described with reference to certain exemplary embodiments thereof, it will be understood by those skilled in the art that a

variety of modifications and variations may be made to the present invention without departing from the spirit or scope of the present invention defined in the appended claims, and their equivalents.

### **[Effects of the Invention]**

As can be seen from the foregoing, according to a brown rice germination apparatus in accordance with the present invention, it is possible to clean and soak brown rice disposed on a porous plate installed at a germination vessel by driving a first underwater motor to supply water stored in a water tank onto the germination vessel, germinate the brown rice in the water by re-supplying water, discharge the water in the germination vessel before the brown rice and the water go bad by circulating hot water at predetermined time intervals, and supply fresh air to the brown rice into which moisture on the porous plate is permeated to germinate the brown rice in an alternate and repeated manner by driving an air injection motor, thereby preventing decay of the brown rice during germination and accelerating germination growth. In addition, it is possible to produce a large amount of brown rice, prevent an odor of malted wheat during germination of the brown rice, and continuously circulate and supply water to remove the need to renew the water, thereby reducing water consumption.

## **[Claims]**

1. A brown rice germination apparatus comprising: a water tank 10 having an introduction chamber 10a for introducing water and a discharge chamber 10b for discharging to store water; a germination vessel 12 for cleaning and germinating brown rice; a porous stainless mesh or plate 16 mounted on a support member 14 installed at both sidewalls of the germination vessel 12 and on which brown rice 16a is disposed on its upper surface to a predetermined thickness; a first underwater motor 20 installed in the water tank 10 to supply water into the germination vessel 12 through a water supply pipe 18 to clean the brown rice 16a disposed on the porous plate 16 and simultaneously germinate the brown rice 16a in the water; a floater 21 for stopping the water being supplied through the water supply pipe 18 when water is supplied into the germination vessel 12 to more than a predetermined level; an overflow pipe 22 installed at one side of an upper part of the germination vessel 12 to overflow water supplied into the germination vessel 12 by driving the first underwater motor 20; a timer 26 for counting a water circulation time carried out by the first underwater motor 20 in order to cut a power supply applied to the first underwater motor 20 when a predetermined time elapses; a water circulation valve 24a for stopping water flow; a heater 28 installed under the germination vessel 12 to heat water stored in the germination vessel 12; a temperature detector 30 for detecting a temperature of the water stored in the germination vessel 12 and cutting the power supply applied to the heater 28 when the temperature is increased to more than a certain value; a discharge pipe 32 for discharging the water stored in the germination vessel 12; an overflow valve 34 installed at a branch pipe 32a of the discharge pipe 32 to control the supply of water discharged from the discharge pipe 32 and the overflow pipe 34 into the introduction

chamber 10a of the water tank 10; a drain valve 36 for discharging the water discharged from the discharge pipe 32 and the overflow pipe 22 to the exterior; a charcoal filter 38 for receiving water and foreign substances introduced through the overflow valve 34 and removing an odor, and being formed of oak charcoal; an air injection motor 40 for supplying fresh air to the brown rice 16a into which moisture on the porous plate 16 is permeated, after opening the drain valve 36 to discharge the water stored in the germination vessel 12; an air supply valve 44 for controlling the air supplied through an air supply pipe 42 by driving the air injection motor 40; and a rice discharge valve 50 installed at a rice discharge pipe 48 to discharge the brown rice 16a germinated on the porous plate 16 by way of water ejected from a water ejection head 45a by driving a second underwater motor 45 into a germinated brown rice dry container 46.

2. A brown rice germination method comprising:

an activation step of evenly spreading cleaned brown rice 16a on a porous plate 16 to a thickness of 5 - 10cm, and driving a first underwater motor 20 for 5 - 8 hours to supply 25 - 30°C water stored in a discharge chamber 10b of a water tank 10 into a germination vessel 12 in a circulation manner, and permeating moisture into the albumen of the brown rice 16a to a concentration of more than 30% to activate the brown rice 16a;

an air germination step of supplying fresh air heated to 25 - 30°C to the brown rice 16a activated during the brown rice activation step and the germination vessel 12 for 2 - 3 hours to germinate the brown rice 16a in the air;

an air/underwater germination step of supplying 32 - 37°C water stored in the discharge chamber 10b of the water tank 10 to the brown rice 16a which is germinated

and grown in the air germination step and the germination vessel 12 for 2 - 3 hours to repeat germination in the water and germination in the air; and

a dry step of receiving the brown rice germinated to a certain size, and removing moisture from the germinated brown rice.

3. The brown rice germination method according to claim 2, wherein, in the air/underwater germination step, the water supplied into the germination vessel 12 is supplied into an introduction chamber 10a of the water tank 10 through a discharge pipe 32 and a branch pipe 32a, 32 - 37°C water introduced into the introduction chamber 10a of the water tank 10 is repeatedly circulated and introduced so that foreign substances and odor contained in the water are filtered by a charcoal filter 38 installed at a center part of the water tank 10.

4. The brown rice germination method according to claim 2, wherein, in the underwater germination step, when 32 - 37°C water stored in the discharge chamber 10b of the water tank 10 is supplied into the germination vessel 12, a second underwater pump 45 is driven to pump the water stored in the discharge chamber 10b of the water tank 10 at one hour intervals so that the water is ejected through a water ejection head 45a to turn the brown rice on a porous plate 16 upside down, thereby preventing damage to the rice bran of the brown rice on the porous plate 16.